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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/883,366	06/19/2001	Toshiya Ishio	1035-330	1077

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EXAMINER

IM, JUNGHWA M

ART UNIT	PAPER NUMBER
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2811

DATE MAILED: 03/13/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/883,366

Applicant(s)

ISHIO ET AL.

Examiner

Junghwa M. Im

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 December 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) 11-16 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 and 17-28 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

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DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1, 17 and 25 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 1 recites a metal layer provided 'only' on a bottom surface of the opening section. As shown in Figures of instant invention, the opening has three surfaces to be possibly defined, and those are a bottom, and two sides. And neither of Figures nor the specification of instant invention discloses a metal layer 'only' on the bottom layer, that is, without any contact on the sides. Furthermore, if the metal layer is (or is shown) thick enough, it is clearly understood that a metal layer is not formed only on the bottom surface of the opening.

Claims 17 and 25 recite a metal layer provided in the opening 'only' on the exposed upper surface of the wiring layer, yet as shown in Figures of instant invention, the metal layer is on contact with the dielectric layer on the sides also.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

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A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claim 1 and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Chikawa et al.(US 5,310,699), hereafter Chikawa.

Regarding claim 1, insofar as understood, Chikawa shows in Fig.2F, a semiconductor device comprising:

a conductive layer (3) which end is inherently connected to an electrical element to perform as a device;

an insulating layer (4) having an opening section on an exposed portion of the conductor layer; and

a protrudent electrode (7) electrically connected to the conductive layer through the metal layer in the opening section,

said semiconductor device, further comprising:

a metal layer (6) provided only on a bottom surface of the opening section on the conductive layer so that said metal layer is provided between the conductive layer and said protrudent electrode.

Regarding claim 17, insofar as understood, Chikawa shows in Fig.2F a semiconductor device comprising:

a conductive layer (3) connected to an electrical element (col.1, lines 49-50) formed on a semiconductor substrate (1); an insulating layer (4) formed on the conductive layer and having an opening therein which exposes an upper surface portion of the conductive layer; a metal layer

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(6) provided in the opening only on the exposed upper surface portion of the conductive layer;
and a protruding electrode (7) electrically connected to the conductive layer via the metal layer.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6, 17 and 20-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Akram (US 5,736,446) in view of Chikawa et al.(US 5,310,699), hereafter Chikawa.

Regarding claims 1 and 17, Akram shows, in Fig. 8j, a semiconductor device comprising:
a conductive layer (1016) having an end that is electrically connected to an electrode pad (1002);

an insulating layer (1018) having an opening section on an exposed portion of the conductor layer; and

a protrudent electrode (1032) electrically connected to the conductive layer through the metal layer in the opening section,

said semiconductor device, further comprising:

a metal layer (1030) provided on the conductive layer in the opening section so that said metal layer is provided between the conductive layer and said protrudent electrode.

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Akram does not teach that a metal layer formed only on the bottom surface of the opening. However, Fig.2F of Chikawa shows a metal layer (6) formed only on the exposed surface of the conductive layer in the bottom of the opening (3).

It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the teaching of Chikawa to the device of Akram in order to form a metal layer only on the exposed conductive layer since the manufacturing process is simplified through removing the unnecessary metal layers on the sides.

Regarding claim 2, Akram shows the protrudent electrode is made of Sn or a metal having Sn as its main component (col. 1, line 54); and

the metal layer is made of Au or a metal having Au as its main component (col.6, lines 6-16).

Regarding claim 3, Akram shows the metal layer has a thickness ranging from 0.003 um to 1 um (col.6, lines 9-15).

Regarding claim 4, Akram discloses in prior art showing a metal layer can be made of Au and Ni (col.2, lines 25-42) in order to obtain better adhesion between the metals.

Also, Akram shows electroless plating for a solder bump (col. 2, lines 46-54, and col.6, lines 38-40).

Regarding claim 5, Akram shows the gold layer has a thickness ranging from 0.003 um to 1 um (col.6, lines 9-15).

Regarding claim 6, Akram shows in Fig. 8j that the protrudent electrode is formed so that the protrudent electrode has a part, which protrudes from the said opening section, of a size

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greater than an area of the opening section. In Fig. 8j, the protruding electrode is ballooned out like a ball with a narrow bottom from the opening.

Regarding claim 20, Fig.2F of Chikawa shows the metal layer (6) in the opening comprises a barrier metal layer (6') and a top layer (6'').

Regarding claim 21, Chikawa discloses the thickness of the top layer is between 0.003 micrometers and 1 micrometer (col. 4, line 27).

Regarding claim 22, Akram shows in Fig. 8j that the protruding electrode is ballooned out like a ball with a narrow bottom from the opening.

Regarding claim 23, Akram shows in Fig. 8j the conductive layer is connected to the electrode pad (1002) via an opening formed in another insulating layer.

Regarding claim 24, Akram discloses that the other insulating layer comprises an inorganic layer (SiO₂; col. 2, line 13) and an organic layer (polyimide; col. 5, line 63).

Claims 7-9, 18, 19 and 25-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chikawa and Akram as applied in claims 1 and 17 above, further in view of Okada et al. (US 6,111,317), hereafter Okada.

.Regarding claim 7, Chikawa and Akram shows a device with all the aspect of the pending claim except the main conductor layer is made of Cu or a metal having Cu as its main component.

Okada, however, shows in Fig. 17 that the main conductor layer (14) is made of Cu (col.4, lines 65-67).

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It would have been obvious to one of ordinary skill in the art at the time of the invention was made to modify the device of Akram and Chikawa using Cu as a conductive layer disclosed in Okada for a solder metal to be wetted easily.

Regarding claim 8, Okada shows in Fig. 17 a barrier metal layer (16) made of Ni or a metal having Ni as its main component, on an entire top surface of the said main conductor layer (col.5, line 2).

Regarding claim 9, Okada shows the barrier metal layer covers side surfaces of the main conductor layer (col.6, lines 45-57).

Regarding claims 18 and 19, Chikawa and Akram show all the aspect of the pending claim a two-layered conductive layers. However, Fig. 5 of Okada shows a three layered (14, 16-1, 16-2; col. 36-45) and the first layer with a barrier layer (16-1) and an adhesion layer (16-2). Also see the relevant portions of the reference such as col. 5, lines 1-45.

It would have been obvious to one of ordinary skill in the art to incorporate the teaching of Okada into the device of Akram and Chikawa in order to have a multi-layered metal layer to improve the adhesion and obtain good electrical contact as taught in col.5, lines 3-6.

Regarding claims 25 and 27, Chikawa and Akram show all the aspect of the pending claim as discussed in claims 1 and 17 except the multi-layered conductive layer. However, Fig. 5 of Okada shows a three layered (14, 16-1, 16-2; col.5, lines 36-45) and the third layer (16-2) made of Ni (col. 5, line2). It would have been obvious to one of ordinary skill in the art to incorporate the teaching of Okada into the device of Akram and Chikawa in order to have a multi-layered metal layer to improve the adhesion and obtain good electrical contact as taught in col.5, lines 3-6.

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Claim 26 is identical to claim 2, and claim 28 to claim 24, and Akram and Chikawa apply to claims 26 and 28 as discussed above.

Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Akram and Chikawa as applied to claim 1 above, and further in view of Stamper et al. (US 6,362,531).

Regarding claim 10, Akram and Chikawa shows a device with all the aspect of the pending claim except the limitations over a foundation metal layer under the main conductor layer.

Stamper et al. show, in Fig. 8, a foundation metal layer (134) made of Ti, Ti-w, Cr, or a metal having any of those elements as its main component, under the main conductor layer (132) (col.8, lines 12-33).

It would have been obvious to one of ordinary skill in the art at the time of the invention was made to incorporate the teaching of Stamper et al. into the device of Akram and Chikawa to enhance adhesion between metal layers.

Response to Arguments

Applicant's arguments with respect to claims 1-10 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (703) 305-3998. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tom Thomas can be reached on (703) 308-2772. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

jmi
March 10, 2003


TOM THOMAS
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800